Redefining technical rescue and casualty care

Autor: McKay S.D.,Johnston J.,Callaway D.W.
Zpracoval: Jaroslav Duchoň

Abstract:
Trauma care in the tactical environment is complex; it requires a unique blend of situational awareness, foresight, medical skill, multitasking, and physical strength. Rescue is a critical, but often over-looked, component of nearly all tactical trauma casualty management. Successful fullspectrum casualty management requires pro ficiency in four areas: casualty access, assessment, stabilization, and extraction. When complex rescue situations arise (casualty removal from roof tops, mountain terrain, collapsed structures, wells, or a karez), casualty care often becomes further complicated. Special Operations units have historically looked to civilian technical rescue techniques and equipment to fill this "rescue gap." Similar to the evolution of pre-hospital military medicine from civilian guidelines (e.g. Advanced Trauma Life Support) (ATLS)) to an evidence-based, tactical-specific guideline (Tactical Combat Casualty Care (TCCC)), an evolution is required within the rescue paradigm. This shift from civilian-based technical rescue guidelines towards an Operational Rescue™ capability allows tactical variables such as minimal equipment, low light/night vision goggles (NVG) considerations, enemy threats, and variable evacuation times to permeate through the individual rescue skill set. Just as with TCCC, in which the principles of casualty care remain consistent, the practices must be adapted to end-users environment, so it is with rescue.
Tactical Combat Casualty Care provided threat-based principles of trauma care that redefined the trauma assessment and stabilization phases of casualty management in the tactical environment. Tactical Combat Casualty Care focuses on eliminating the potentially preventable causes of death on the battlefield. By training every warrior in the principles of TCCC, the U.S. military has reduced combat mortality to the lowest levels in recorded history. Tactical combat casualty care is now considered the pre-hospital standard of care and is utilized by all Services with great success because every operational person has a quantifiable casualty care capability.
However, the principles of TCCC are predicated on an ability to access the casualty and, ultimately evacuate the casualty to higher echelons of care.8 During this same period of great advances for casualty care, units have continued to try to apply civilian technical rescue practices to a tactical and operational rescue problem. This practice, just like trying to utilize Advanced Cardiac Life Support (ACLS) on the battlefield before TCCC, quite often results in a capability gap when the rescue problem presents in the middle of a tactical operation. Since every operational person has a standing rescue requirement to remove himself/herself and others from hazards in remote and often dangerous environments, every operational person needs to have an operational rescue capability.
Observations of training, review of mission after action report's (AAR's), and ad hoc discussions with returning SOF units indicate that there exists a significant gap in terms of how first responders access and extract casualties in the tactical environment. The dynamic changing of the tactical landscape for SOF personnel presents new and asymmetric rescue challenges for the unit consisting of urban rooftops, vehicle entrapment, collapsed structure, below-grade wells/karez extrication, high altitude mountain regions, and various water features. This work suggests that there exists a requirement within the Special Operations community to develop principles of rescue and to build appropriate tactics, techniques and procedures (TTPs) for the operational environment. This paper provides an overview of operational rescue, discusses existing rescue standards, provides a gap analysis based upon existing threats, and proposes a starting point for developing best practices for rescue in the operational and tactical environment.

Gap Analysis: Existing technical rescue training is over-reliant on civilian standards
Rescue on the modern battlefield is increasing complex. The increased power of modern munitions, large scale deployment of armored vehicles, necessity of vertical small unit combat in low intensity conflicts, and enemy tactics of targeting response personnel mandate new approaches to accessing and extracting casualties. Several shortcomings in rescue have been recognized over the last few years. First is the near total reliance on civilian experience and equipment to develop operational rescue training and TTPs. Though civilian standards offer a solid starting point, after ten years of conflict, training and operations we still use these TTPs, largely without modification. Special Operations Forces as a whole has yet to effectively examine battlefield threats, analyze AARs and develop operationally based rescue TTPs specific to modern combat.

Second, there is a lack of successful rescue related research and development (R&D) in the SOF community. There exists a wide variety of kit utilized in the current operational space, much of which adheres to civilian rescue specifications set forth by the National Fire Protection Association guidelines for General, or "G" rated rescue. Most of this kit meets the key performance parameters of fire-rescue personnel responding to traditional technical rescue calls, not SOF personnel working in an entirely different area of operation with significantly different threats and organic assets.

Finally, valuable pre-deployment time is being consumed by rescue training that is not specifically threat-based or, at times, operationally relevant. Current training also does not use a ground up or phased approach that trains a team of individuals that will be working together in the operational environment (i.e. an Operational Detachment Alpha (ODA)). As a result, skills may be taught and equipment purchased without creating a demonstrable rescue capability.

As with the evolution of pre-hospital battlefield trauma care from pure civilian ATLS to threat-based TCCC, technical rescue must undergo a transition. A basic understanding of civilian rescue standards is an important starting point. Armed with kanowledge of the history, purpose, strengths and weaknesses of these standards, the individual unit can build a robust, full spectrum operational rescue program.

The Civilian Standards: National Fire Protection Association (NFPA)

The primary standard setting organization in the civilian response world is the National Fire Protection Association (NFPA). The NFPA is a publisher of consensus standards that primarily deal with fire and life safety, create professional qualifications for firefighters and technical rescuers, and provide a common foundation and vernacular of minimum standards for which civilian technical rescue organizations can adhere. Committee members consist of end users, manufacturers, professional trainers, and academics. There are U.S. military personnel on a few of the committees; however, these personnel are primarily associated with military fire service operations. Currently, the Department of Defense (DoD) has endorsed the NFPA guidelines as the early standard for rescue within tactical environments. Examining NFPA is an appropriate first step in the development of operationally relevant rescue protocols. However, too often, the NFPA label is stamped like a blank check, encouraging procurement officials to purchase equipment without adequate due diligence. As with early military medicine based solely upon civilian trauma guidelines, NFPA standards were designed for distinctly different mission profiles, limiting application within full-spectrum rescue. There are three NFPA standards that are relevant for SOF practitioners to understand:

1. NFPA 1983, Standard on Life Safety Rope and Equipment for Emergency Services
2. NFPA 1006, Standard for Technical Rescuer Professional Qualifications
3. NFPA 1670, Standard on Operations and Training for Technical Search and Rescue Incidents

NFPA 19839

NFPA 1983, 6th Ed. defines design and strength specifications for life safety equipment manufactures. The standard includes detailed testing and production requirements to ensure compliance. National Fire Protection Association 1983 is frequently misinterpreted, especially outside of the dedicated fire rescue community, and utilized to make equipment and training selections outside of the technical rescue environment. It is important to note that NFPA 1983 is NOT an end-user standard; it is a manufacturer's standard.

NFPA 1983 section 1.1.5 states:

"This standard shall not specify requirements for any rope or associated equipment designed for mountain rescue, cave rescue, lead climbing operations, or where expected hazards and situations dictate other performance requirements." In the SOF mission profile, "expected hazards and situations" frequently "dictate other performance requirements." As our current conflict continues and broadens, more operations are being conducted in mountainous environments and austere desert terrain. These missions require a unique skill set that accounts for ongoing threats, while incorporating multiple disciplines of access and rescue to include mountain rescue and lead climbing techniques. It is this standard that was chosen as a requirement in the Special Operations Forces Casualty Evacuation (SOF CASEVAC) Performance Specification document (section 4.1.2.1.2, 12 March 2010).

Despite operational limitations, NFPA 1983 does provide a valuable starting point. NFPA 1983, similar to ANSI (American National Standards Institute) or UIAA (Union Internationale Dees Association D'Alpinisme), provides a respected, external, theoretically unbiased, testing standards for rescue equipment construction and strength. This validation provides administrative, accounting, training, and policy benefits for large systems (such as the DoD) and to newcomers to the rescue arena. However, the power is in the NFPA metrics, not the NFPA stamp. There is exceptional equipment on the market by respectable manufactures that is not NFPA 1983 tested. Barriers include NFPA irrelevance to utilization (e.g. Alpine or mountaineering utilization), gear designed for specific missions (e.g. NFPA 1983 does not cover fall protection in general industry), and economic constraints (a company must pay to have the NFPA stamp placed on its individual gear, thus increasing the price to the end-user). For example, the Petzl Micro Traxion does not have a NFPA 1983 certification, but is utilized extensively in the professional climbing, mountaineering, and canyoneering communities, and provides an extremely valuable capability in the operational environment.

Though a "certified" product may be desired for certain applications, it may not be practical. End users should be familiar with NFPA 1983 standards and use them as a comparison reference in gear selection. This provides a solid starting point to determine whether the product's strength and testing guidelines are in-line with the known manufacturer's standard.

NFPA 1006

NFPA 1006 is part of the professional qualifications series contained within NFPA. Established in 1994, the committee has maintained their commitment to establish credible rescuer qualifications without tying the hands of the Authority Having Jurisdiction (AHJ). The most important change to NFPA 1006 occurred in 2008 when the layout of the standard was changed to fall in line with other NFPA pro-qual standards.

NFPA 1006 is one of the most applicable standards for USSOCOM. The power of NFPA 1006 is that it does not specify particular technique or equipment in any of the standards. The standard is laid out in basic job performance requirement (JPR) fashion. The JPR is described and then supported with the requisite skills and knowledge required to master the requirement. This is where the Special Operations community can benefit from the standard. For example, Chapter 6 - Rope, Level 1, 6.1.1 is the JPR for the rescuer to be able to construct a multiple-point anchor. In a traditional fire-rescue rope rescue course, this would be accomplished using webbing slings or a length of rope. However, in SOF, your multiple-point anchor could consist of climbing cams, nuts, another operator, or cordelette. The standard is flexible enough for instructors to tailor their program to the operational environment.

NFPA 1006 also gives the AHJ flexibility in selecting equipment to complete the JPR. Structural collapse training predominately consists of rescuers learning how to construct and apply the various FEMA wood shoring systems. Numerous USSOCOM units have attended this training; however, we would argue how applicable is this? How many times has the U.S. military loaded a cache of lumber to be sent to the Hindu Kush, or Kandahar for the purpose of searching a collapsed building? How many SOF teams have designated "cut teams" prepared and equipped to begin constructing the needed elaborate shoring with this lumber once delivered? The 1006 committee identifies that there are end-users that may have a different equipment need and/or approach. A good analogy is to think of the skills learned in NFPA 1006 as a toolbox; each skill is a tool in that toolbox. While some of the tools will be used on most rescues, some tools will not be applicable. This is up to the trained rescuer to decide. The NFPA does have sample toolkits in the Annex of the standard. However, these tool kits are for information purposes only and are not part of the standard requirement. The AHJ defines components of the toolkit. For example, during a SOF collapse rescue response, the rescue toolkit may only consist of organic and natural assets found at the collapse scene. An often confusing example of NFPA 1006 in practice relates to the NFPA and System Safety Factors (SSF). NFPA does not specify a SSF (the overall safety factor once all system components are in place, e.g. rope, knots, hardware, and software) for a rope system. The committee on professional qualifications (NFPA 1006) recognizes that only the AHJ can identify the operating parameters of its technical rescue team. A rescue team that only works in an urban low angle environment has the luxury of SSF's of 10:1 or more. As the rescue moves to a high-angle rural environment, or as the tactical threat level increases, that SSF could be lowered to 5:1 (or less). To put this into perspective a regimental size force may state a 8:1 SSF, while smaller recon size or reduced signature element may allow a lower SSF due to operational requirements. Each organization should allow for a range within the SSF spectrum in order to maintain response flexibility based on operational demands.

The SSF issue highlights the difficulty in applying civilian standards en bloc to the SOF environment. NFPA 1983 is frequently cited (incorrectly) as requiring a 15:1 SSF. This is only true for the safety factor (SF) of the preferred life-safety rope. A 1/2" rope has a required breaking strength of 9,000 lbs (40kN). The original writers of the standard felt that a 600 lb load was typical of a 2-person rescue (includes victim, rescuer and equipment). Through simple division we can calculate a 15:1 safety factor; note this is different than a SSF. The 15:1 safety factor is a manufacturer requirement and only applies to an unknotted rope, not to the entire system. Unless you are making rope, this 15:1 safety factor does not apply. As a side note, the safety factor for the aircraft industry is 1.5:1, while human space travel is 1.4:1. It stands to reason that fundamental expertise in the areas of engineering analysis, physics, redundant safety, and a thorough comprehension of full spectrum application are a prerequisite for such a narrow factor of safety.

A final benefit of NFPA 1006 is the "Core + 1" minimum requirement for certification. There are nine different disciplines of rescue addressed in 1006 to include; rope rescue, surface water rescue, vehicle and machinery rescue, confined space rescue, structural collapse rescue, trench rescue, subterranean rescue, dive rescue, and wilderness rescue. Prior to going after a certification in any of the above-mentioned disciplines a "core" capability is achieved.

These general job performance requirements (the "core") are found in Chapter 5 of NFPA 1006. Any unit, based on their current area of operations and mission profile, can select those specialties or disciplines they deem mission critical. If at any time, the AO and/or mission profile changes, it is an easy "plug and play" capability to enhance their individual certification into other disciplines since the "core" has already been obtained.

NFPA 167011

NFPA 1670, 3rd Edition (4th Edition in publication) is the Standard on Operations and Training for Technical Search and Rescue Incidents. There are several relevant sections of 1670 worth discussing.

1.1.1 "The standard shall identify and establish functional capability for conducting operations at technical search and rescue incidents while minimizing threats to rescuers."

1.1.2 "The requirements of this standard shall apply to organizations that provide response to technical search and rescue incidents, including those not regulated by government mandates."

1.1.3 "If is not the intent of this document to be applied to individuals and their associated skills and/or qualifications."

While the scope is fairly straight forward, it is worth noting that NFPA specifically calls for this standard to apply to any organization that provides rescue services to include law enforcement (A1.1.2). As stated in the scope, the primary purpose of NFPA 1670 is to create a system whereby the AHJ can assess technical rescue hazards within the response area and to identify the AHJ's level of operational capability. As an example, when we conduct an evaluation on a team's operational capability we use NFPA 1670 as a template.

NFPA 1670 breaks operational capability into three distinctive categories:

-Awareeness

-Operations

-Technician

ifying the appropriate resources and establishing an adequate command system to receive those resources.

An awareness capability is designed to protect untrained personnel by educating them on the hazards associated with a technical rescue incident. Awareness personnel also receive instruction on identifying the appropriate resources and establishing an adequate command system to receive those resources. NFPA 1670 describes capability for many facets of technical rescue to include rope, structural collapse, confined space, vehicle and machinery extrication, water (surface, swift, dive), wilderness search and rescue, trench, cave, and finally, mines. The operations level allows the team to perform certain types of rescues per the standard. For instance an operations level rope rescue team may perform high-angle and low-angle rescues when the victim is at the height of the rescuers (i.e., the victim has been carried to the bottom of the vertical face and must be hauled or raised. The technician level is considered the highest level of capability. Technician level teams are capable of performing rescues in the "hot zone," and utilize specialized equipment and techniques. In contrast to the previous rope rescue example, a technician level team can perform mid-face pickoffs, and use tensioned rope systems.

Does the standard require all team members to be qualified to the operational capability? The answer is no. With the exception of Chapter 7 Confined Space, the standard does not state how many personnel are needed to make up the team. Confined space includes this information due to specific OSHA confined space entry requirements. Obviously, common sense must prevail. A team will not pass a rope rescue operations level evaluation where one member is trained to rope Level 1 under NFPA 1006. The team must have adequate resources to function at the level they wish to attain. Although not previously mentioned in the "relevant" NFPA guidelines, but at least deserves an honorable mention due to its direct correlation to SOF rescue is NFPA 1407. NFPA 1407 is the Standard for Training Fire Service Rapid Interventions Crews. The term rapid intervention crew (RIC/RIT) describes a fire service element whose sole responsibility is to rescue their own, other firefighters who get into trouble whether it is disorientation, entanglement, or building collapse. This team deploys immediately and aggressively once any one of multiple criteria are met, primarily a "mayday" from an interior fire suppression crew. Due to the extreme circumstances that these rescues are preformed under, there is no handcuffing of the rescuers by rigid standards. The training reflects the capabilities needed to intervene effectively during this type of crisis, often with limited equipment and personnel. Incorporating the methodology of this standard is a must for Special Operations units. It allows units to train for a true executable capability based on a P-A-C-E (Primary, Alternate, Contingency, Emergency) mindset.

Operational Rescue™ Requirements for SOF

Developing relevant techniques and principles for casualty access and extraction is critical for SOF. There are certain universal operational rescue principles for conducting all the various disciplines (rope rescue, confined space, structural collapse, etc.), which remain relatively consistent such as redundant safety processes, emphasis on simple techniques that transcend terrain, and extensive utilization of organic and natural assets. However, successful implementation requires a tiered response depending on many factors such as training, equipment, personnel on hand, environmental context, and mission profile.

Operational Rescue™ requirements should be developed based on unit specific tasks and current operational environments. However, these requirements should build upon basic principles and concepts derived from examining current threats and real operational capabilities. This strategy allows for a reasonable plan to be put in place for contingencies. Casualty access is the pivotal point in rescue. The rescue usually involves an unplanned for situation in a very fluid environment complicated by factors such as enemy contact, limited organic rescue assets and variable capabilities. Lack of proper management results in an uncoordinated and dangerous response. A basic understanding of rescue for high-frequency-high threat scenarios (e.g., accessing vehicles, horizontal and vertical movement, and post-blast collapse) is vital. Training on specific threats using basic techniques and equipment must be done prior to developing more advanced TTP's. This can be as basic as running rehearsals of opening an RG vehicle door with the provided safety wrench and securing the weight of the door with tubular nylon as if it were on its side.

Often these basic techniques are the quickest and most effective on the battlefield. Their simplicity makes them more resistance to failure than other specialty kits or equipment that may not perform as effectively under stress due to damage, poor PM, or set up times. Further, this prevents reliance on specific techniques with specialized equipment (i.e., rescuing a teammate fallen into a well using pre-packaged rope kit vs. using elements common on the battlefield like a section of tubular nylon or weapon slings) and allows creative problem solving.

Casualty Extraction is a dynamic process defined as movement of the casualty from point of injury to the next casualty management point (e.g., casualty collection point (CCP), evacuation vehicle, battalion aid station/ combat support hospital (BAS/CSH), etc.). The process of planning an extraction begins during the access phase and permeates throughout the assessment and stabilization components of casualty management. Certain injuries (e.g. a spinal column trauma) and certain interventions (e.g., tourniquet or chest needle decompression) shape extraction techniques.

Casualty access and extraction considerations should include:

1. Initial securing of the casualty for movement: This will vary based on threat level, distance to next care point, mission profile, manpower, etc. This may include fire suppression, utilization of securing device, or simply a "grab and go."
2. Type of movement: horizontal, vertical, confined space/ limited access, combination
3. Concept of phased movements

-<10 meters: In a high threat environment,moving casualty to first point of cover may entail one or two-man drag, ”grab and go” technique is typically preferred over webbing or drag device due to limited exposure on “x”, and deployment of security personnel. Utilization of small muscle groups such as forearms and biceps may work, but fatigue quickly and affect fine motor skills post- rescue.
-10-50 meters: Longer movements take a larger toll on rescuers and require a degree of planning. This is where a simple webbing loop or drag strap becomes helpful to decrease the casualty’s coefficient of friction and to gain a slight offset to better leverage rescuer’s weight to gain momentum.
->50 meters: Should utilize litters, friction reduction devices, possibly multiple rescuers.
Type and extent of injury: For example, vertical lowering with an individual harness is less than ideal with pelvic injuries and should be avoided if possible. The ability to combine a “non-load rated” patient immobilization device (i.e. litter) a “load rated” patient extraction device (i.e. XS-1 or tubular webbing) creates a vertical extraction capability.

Planning and Preparation

Planning and preparatory training for operational rescue is a key. The applicability of equipment as well as the focus and audience for training is paramount for appropriate application on the battlefield. Many factors must be incorporated into the proper outfitting and application for contingency operations. We encourage all end-users to create a template for their specific operational parameters for all equipment and technique selection with an end-goal of a leaner profile and robust capability asset. Select each piece of gear you intend on using for rescue not just for it’s individual capabilities, but for how it performs within the system and how it articulates with other pieces of gear. The end-user should not assume that all rope and all hardware will function flawlessly when used as a system.

As mentioned earlier, a phased approach would best fit the force. This approach would look at the current threats to the force and then plan according much like using mission, enemy, time, terrain, and troops (METT-T) planning checklist; however, on an Operational Rescue™ contingency format.

Basic battle drills of hatch opening by both normal wrench unlocking methods and forcible entry methods would be a primary planned contingency for troops operating with RG series vehicles or mine resistant ambush protected (MRAPs) along areas of road that were prone to give way and cause a vehicle roll over. After the access the drill would continue with basic recovery of unconscious personnel using standard one-inch tubular nylon. Once the basic necessities for contingency planning can be effectively executed by all on the team then more advance techniques and equipment can be trained on.

Often when planning for contingencies one finds that either the equipment is readily available or not available at all. This is why the basics play such an important role. In cases where the equipment is available it quickly adds weight and cube space to the package. Most large-scale rescue equipment that the military has adapted has come from the civilian TTP’s, usually from the fire rescue/vehicle extrication templates. Often this equipment is based on one function and power or advantage (e.g., hydraulic, battery, fuel, etc.). In these civilian agencies weight and cube space are at a maxim when responding to a rescue in a fifteen-ton vehicle. The same can be said on techniques used and commonly trained on by the military. Countless sedans and SUV cars have been cut up by troops training on vehicle extrication; however, these by no means are the actual vehicles they are driving in an everyday combat theater. This inherently is the problem that the same requirements and considerations that needed in civilian rescue are not the same for operational rescue on the battlefield.

One last and probably the most important aspect of crossing over TTP’s is the leadership, knowledge, and experience. Civilian rescue crew are specifically trained and focused in their trainings. They respond fresh to a call for help outside their team. When they respond the team has a predetermined leadership and role assignments that allows them to effect a rescue. In an operational rescue environment the call for help and the rescuers are all in the same and potentially deadly battlefield environment under the same conditions. In the case of an ODA one third or more of the team can become victims. In this environment it is unrealistic to expect the team to react in the same style or training as civilian-based organizations because of their small numbers and the randomness in which team members become casualties.

Rescue is never conducted in a vacuum. It is a tactical and a team problem that requires small unit training. Operational rescue training conducted solely at an individual level (i.e. just the two medics on an ODA) may teach skills, but does not create a capability. Much like a mass casualty (MASCAL) situation, there are many jobs that have to be managed in a rescue (e.g., security, casualty movement, communication, tactical C2, etc.).

Small unit training grounded in the basic principles of Operational Rescue™ and incorporating tactical leadership, decisionmaking, personal accountability, and multi-tasking is critical to preparing our warriors for rescue on the battlefield.

Conclusion

Like TCCC, Operational Rescue™ is a basic Soldier, Sailor, Marine, and Airman survival skill. In high-threat environments, rescue and casualty care are intimately linked. Reports show that access to the casualty and extraction of the casualty are playing major roles in the provision of adequate TCCC. If rescuers cannot reach the casualty, they cannot stabilize. If rescuers cannot extract the casualty to higher echelons of care, the parameters of TCCC interventions and damage control resuscitation are stretched.

Each SOF unit will have unique mission profiles and organic assets. Therefore, each unit should perform internal capability gap analysis specific to rescue and fullspectrum casualty management. NFPA can and should add an organizational structure and professionalism to any unit's training profile. NFPA guidelines (1983, 1006, 1670, and 1407) should be viewed as separate maps to orient and guide an organization and/or individual to their specific end goal identified by their gap analysis.

Units should not underestimate the power of the AHJ clauses in determining individual requirements. Due to the wide spectrum of specialties within USSOCOM, each individual unit (and probably in some cases separate elements within a unit) should designate their own AHJ that defines capabilities, equipment, and techniques. To have a single point AHJ for all of USSOCOM would be impractical due the wide variances of mission profiles and key performance parameters of individual units.

Recommendations

1. SOF Commands should be held accountable for creating a rescue capability: Operational rescue is an individual and team skill, but command responsibility.
2. Each component of a SOF command should define the basic standards for operational rescue based upon the principles above and develop TTPs based off threat-based operational requirements and past experiences from the forces on the ground. This can be done in consultation with NFPA Guidelines, but should integrate Operational Rescue™ experts and not focus on civilian or industrial TTPs.
3. Sustainable training is critical. Training programs should consider the formation of mobile training teams that incorporate unit-specific threats, equipment limitations, rapid translation of battlefield lessons learned, multi-modal training (e.g. online preparation with heavy practical application on MTT arrival) and frequent updates.
4. Equipment selection process should be chosen based off of battlefield requirements and warrior feedback.
5. Technique and equipment evaluation/selection should include execution under stress and sympathetic nervous system activation.
6. Operational Rescue™ should be integrated into TCCC training modules at the team level.

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Jaroslav Duchoň